

Kolb et al.

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**REMARKS**

Claims 1, 2, and 4-26 are pending in the present application. In the Office Action mailed January 12, 2005, the Examiner rejected claims 1, 2, 11, 12, 17, and 22 under 35 U.S.C. §102(b) as being unpatentable over Ojima et al. (USP 4,419,643). The Examiner next rejected claims 4-8 and 13-16 under 35 U.S.C. §103(a) as being unpatentable over Ojima in view of Mumbower (USP 4,845,392). Claims 23-26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ojima et al.

Before addressing the Examiner's rejections, Applicant notes two separate procedural issues in the present application that must be addressed. Firstly, in response to the restriction requirement made final in the Office Action mailed June 30, 2003, Applicant filed a Petition Under 37 C.F.R. §1.144 for Supervisory Review of Restriction Requirement on August 17, 2004. To date, no decision has been received on Applicant's Petition for rejoinder of claims 18-21. Accordingly, Applicant has filed contemporaneously herewith a Status Inquiry with respect to the aforementioned Petition. Secondly, in the Office Action mailed January 12, 2005, the Office Action Summary notes that, "This action is non-final". Office Action, January 12, 2005, Office Action Summary. In contrast, the "Conclusion" section of the Office Action states, "THIS ACTION IS MADE FINAL". *Id.*, p. 6. Moreover, the "document description" for the PAIR entry corresponding to the January 12, 2005 Office Action characterizes the office action as a "Non-Final Rejection". As such, it is unclear as to finality of the Office Action of January 12, 2005. Therefore, in light of this incongruity, it is believed that the Office Action Summary, as a summary of the substance of the Examiner's Letter, more accurately reflects the Examiner's intention with regard to the status of the January 12<sup>th</sup> Office Action and this intention is further manifested in the "Image File Wrapper" for the present application which characterizes the current Office Action as "non-final". As such, it is believed that the January 12<sup>th</sup> Office Action is a "non-final" action and the amendments/remarks presented herein are to be considered responsive to a "non-final" action.

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Claims 1, 2, 11, 12, 17, and 22 stand rejected under 35 U.S.C. §102(b) as being anticipated by Ojima et al. The reference is directed to “a self-sustaining solenoid which is adapted so that when applying an operating current in a coil, a moving iron core disposed in the coil is *attracted* into contact with a fixed receiver”. Ojima et al., Abstract, emphasis added. That is, Ojima et al. teaches a solenoid whereby forces of *attraction* are exploited to translate an iron core disposed within a coil into contact with a fixed receiver. In contrast to the conclusions reached by the Examiner, Ojima et al. neither teaches nor suggests the application of a *repellant* force to bring a movable iron core in contact with a fixed receiver.

Ojima et al., as shown in Fig. 3, discloses a solenoid (10) having an annular permanent magnet (14) that is mounted near the end of a movable iron core (16). The solenoid also has a cylindrical member (15) that defines a volume in which the iron core is to move in response to the inducement of current in a coil (40) wrapped around the cylindrical member. When the movable iron core is at its original or at-rest position, two separate magnetic gaps are defined. One magnetic gap (18) is defined between the iron core and a fixed receiver (13). The other magnetic gap (44) is defined between “an outer peripheral surface of the moving iron core 16” and “the inner peripheral surface of the opening 41” that is radially defined between yoke proper (11) and the iron core (16). Col. 6, ll. 31-37. These magnetic gaps are exploited to control translation of the iron core toward the fixed receiver.

Specifically, gap (18) is sized to be larger than gap (44) when current is not induced in the coil. In this regard, “when the moving iron core 16 and the fixed receiver 13 are spaced apart, the magnetic fluxes emanating from the permanent magnet 14 set up two closed magnetic paths in the solenoid.” Col. 6, ll. 50-53. That is, “a first closed magnetic path is formed via route [magnetic pole N – intermediate portion 11a – gap 44 – cylindrical member 15 – moving iron core 16 – cylindrical member 15 – magnetic yoke 42 – magnetic pole S], and a flux  $\phi_1$  is confined in the first closed magnetic path.” Col. 6, ll. 54-59. Ojima et al. further teaches, “A second closed magnetic path is formed via a route [magnetic pole N – intermediate portion 11a – magnetic yoke proper 11 – coupling portion 12 – fixed receiver 13 – gap 18 – moving iron core 16 – cylindrical member 15 –

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magnetic yoke 42 – magnetic pole S], and a magnetic flux  $\phi_2$  is confined in the second closed magnetic path.” Col. 6, ll. 59-65. Ojima et al. continues, “In the second closed magnetic path, as the magnetic resistance in the gap 18 is markedly higher than in gap 44, the magnetic flux  $\phi_2$  confined in the second closed magnetic path is appreciably smaller in quantity than the magnetic flux  $\phi_1$  confined in the first closed magnetic path...” Col. 6, l. 65 – col. 7, l. 2. As a result, “in the state in which neither of the operating and release current is applied to an operating and release coil 40, the moving iron core 16 would not be moved by the magnetic energy of the second closed magnetic path because the magnetic flux  $\phi_2$  is small in quantity.” Col. 7, ll. 5-9. In short, the flux in the first closed magnetic path exceeds the flux in the second closed magnetic path and, as a result, the iron core is *attracted* to the permanent magnet via the first closed magnetic path. As set forth below, however, when an operating current is applied to the coil, the flux in the second closed magnetic path exceeds the flux of the first closed magnetic path and, as a result, the permanent magnet *attracts* the iron core via the second closed magnetic path.

Specifically, when an operating current is applied to the operating and release coil, the direction of the magnetic flux in the core produced by the coil coincides with that of the flux  $\phi_2$  from the permanent magnet. As a result of the application of the operating current, a third and a fourth closed magnetic path are created within the solenoid. See col. 7, ll. 19-30. The fluxes associated with the third and fourth closed magnetic paths together with the flux of the second closed magnetic path exist along the path of the iron core. See col. 7, ll. 31-35. As a result of these magnetic fluxes (the fluxes from the second, third, and fourth closed magnetic paths), “the moving iron core 16 is subjected to a force which moves it towards the fixed receiver 13.” Col. 7, ll. 35-37. This is a result of the flux of the first closed magnetic path and the flux of the third closed magnetic path being in opposite directions in gap. See col. 7, ll. 36-37. As such, “when the flux  $\phi_3$  (of the third closed magnetic path) becomes larger than the flux  $\phi_1$ , the flux  $\phi_1$  is forced to take the second closed magnetic path.” Col. 7, ll. 39-41, parentheses added. The moving iron core is thus moved toward the fixed receiver “by the magnetic energy of the second, third and fourth closed magnetic paths”. Col. 7, ll. 45-46. In short, the iron core moves toward the permanent magnet as a result of the *attraction*

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therebetween, but moves toward the permanent magnet along the second, third and fourth closed magnetic paths. While this results in the iron core moving away from the permanent magnet within the body of the cylindrical member, the iron core is *not* repelled by the permanent magnet -- it is *attracted* by it.

This is particularly illustrated in Fig. 4 which illustrates translation of the iron core toward the fixed receiver. As shown, the second, third, and fourth closed magnetic paths include the fixed receiver. As such, when the flux of the third closed magnetic path exceeds that of the first closed magnetic path, which does not include the fixed receiver, the collective flux of the second, third, and fourth paths is sufficient to overcome the magnetic resistance of gap and, as a result, the iron core moves toward the permanent magnet along the second, third, and fourth closed magnetic paths, but such movement is inhibited by the fixed receiver. Thus, the permanent magnet *attracts* the iron core via the second, third, and fourth flux paths. Or, as explicitly stated by Ojima et al., "an operating current is applied to the operating and release coil 40 so that the direction of the magnetic flux in the core 16 produced by the coil 40 may *coincide* with that of the flux  $\phi_2$  from the magnet 14." Col. 7, ll. 13-16, emphasis added. This coincidence illustrates an *attraction* force between the iron core and the permanent magnet when an operating current is induced in the coil, not a repellant force.

In contrast, claims 1 and 11 call for a permanent magnet that attracts a movable magnetic object or armature when a coil is dc-energized and repels the object or armature when the coil is energized. To clarify that the aforementioned attraction and repelling is a result of magnetic forces, claims 1 and 11 have been amended to call for "magnetic" attraction and "magnetic" repelling. As set forth above, Ojima et al. neither teaches nor suggests controlling movement of a movable object in the manner called for in claims 1 and 11. Specifically, Ojima et al. fails to teach or suggest movement of a movable object using both attraction and repellant forces. Accordingly, it is believed that claims 1 and 11, as well as those depending therefrom, are patentably distinct from the art of record.

The Examiner also rejected claim 22 in light of the teachings of Ojima et al. Claim 22, as amended, calls for, in part, a non-magnetic spacer disposed in a path in which a movable plunger is configured to move. This is in direct contrast to that taught



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by Ojima et al. As shown in Fig. 3 of Ojima et al., the reference teaches an annular non-magnetic spacer that is situated between an iron core and a permanent magnet; however, the spacer is not positioned between the core and the magnet in a path in which the core is designed to move. That is, the cited reference teaches a non-magnetic spacer that extends circumferentially around the path in which core is designed to move, but is not *in* the path, as presently claimed. In other words, the spacer taught by Ojima et al. cannot limit linear movement of the iron core, whereas the claimed non-magnetic spacer can given its position *in* the path in which the claimed plunger is configured translate. Accordingly, it is believed that claim 22, as amended, is patentably distinct from that taught and/or suggested by Ojima et al.

Claims 23-26 stand rejected under 35 U.S.C. §103 as being unpatentable over Ojima et al. Similar to claim 22, claim 23 has been amended to clarify the position of the non-magnetic spacer relative to the permanent magnet and the armature. Specifically, claim 23 has been amended to clarify that the spacer is disposed between the permanent magnet and the armature along the direction of linear movement. Claim 23 has also been amended to clarify that the permanent magnet is configured to be positioned in the direction of linear movement and further amended to clarify that the armature moves within the bobbin in the direction of linear movement. As set forth above, the non-magnetic spacer disclosed by Ojima et al. is not in the direction of the linear movement of the iron core. That is, Ojima et al. teaches an annular spacer that is positioned orthogonal to the direction of linear movement of the iron core. In short, Ojima et al. neither teaches nor suggests a permanent magnet, armature, and spacer that are all positioned in a common direction. As such, it is believed that claims 23-26 are patentably distinct from that taught and/or suggested by Ojima et al.

Regarding the rejection of claims 4-8 and 13-16 under 35 U.S.C. §103(a) as being unpatentable over Ojima et al. in view of Mumbower, Applicant respectfully disagrees with the Examiner with respect to the art as applied, but in light of the aforementioned claims depending from what are believed otherwise allowable claims, Applicant does not believe additional remarks are necessary and requests allowance of claims 4-8 and 13-16 pursuant to the chain of dependency.

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Applicant request entry and consideration of claim 27 newly presented herein.

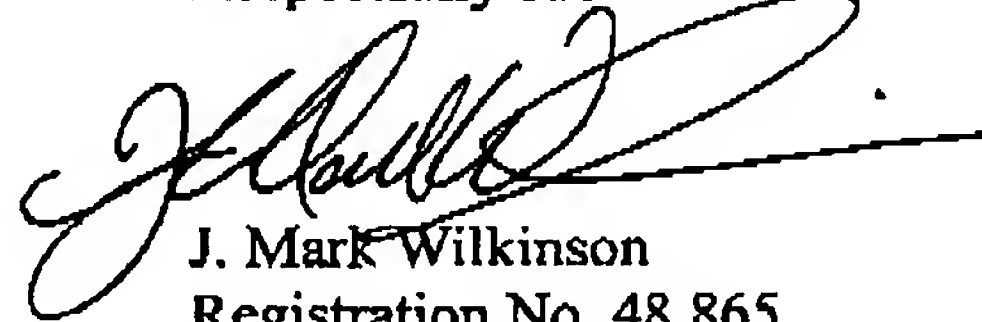
The Examiner indicated that Applicant's arguments presented November 15, 2004 were "moot in view of the new ground(s) of rejection." That is a mischaracterization. Applicant's remarks filed November 15, 2004 were persuasive and overcame the previous rejections and, as a result, the Examiner conducted further searching and provided new bases of rejection in light of newly discovered art. Accordingly, Applicant requests that in a subsequent action that the Examiner clarify that the remarks presented on November 15, 2004 were persuasive and, thus, the need for further searching and examination of the claimed invention by the Examiner.

Therefore, in light of at least the foregoing, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 1, 2, and 4-27.

A credit card authorization in the amount of \$50.00 is also enclosed for fees associated with entering the claim newly presented herein.

Applicant appreciates the Examiner's consideration of these Amendments and Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

Respectfully submitted,



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